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Notes on Geographic Distribution

Update on the distribution of *Diphylla ecaudata* Spix, 1823 (Mammalia, Chiroptera): New records from the Brazilian northeast

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Abstract: The subfamily Desmodontinae encompasses the only mammals known to feed exclusively on the blood of other vertebrates. This study provides records of the desmodontine bat *Diphylla ecaudata* from a major gap in its known distribution in northeastern Brazil. Specimens were captured at five localities, all associated with caves. Two of these sites are located in the state of Sergipe, two in Bahia, and one in Ceará. The record of *D. ecaudata* from Ceará is the first for this state.

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Phyllostomidae is one of the most diverse bat families in both morphological and ecological terms, covering the full diversity of chiropteran feeding niches, including species that are insectivorous, nectarivorous, frugivorous, carnivorous, omnivorous, and sanguivorous (Kunz 1982). The subfamily Desmodontinae is composed of the only three mammal species known to feed exclusively on the blood of other vertebrates— the Common Vampire Bat, *Desmodus rotundus* (É. Geoffroy, 1810), the White-winged Vampire Bat, *Diaemus youngii* (Jentink, 1893), and the Hairy-legged Vampire Bat, *Diphylla ecaudata* Spix, 1823 (Kwon and Gardner 2008).

Diphylla ecaudata occurs between México and southern Brazil, with records from Colombia, Venezuela, Ecuador, Peru, and Bolivia (Greenhall *et al.* 1984; Kwon and Gardner 2008). In Brazil, the species is found in all biomes (Paglia *et al.* 2012). There is an apparent lacuna between the central Amazon basin and southwestern South America, however, which suggests a potentially disjunct distribution for the species in this continent (Kwon and Gardner 2008). Prior to the present study, there was also an extensive gap in the known distribution of the species in the Brazilian Northeast. The present study provides records of *D. ecaudata* from five new localities (Figure 1), two in the Brazilian state of Sergipe, two in Bahia, and one in Ceará. In all five cases, the occurrence of *D. ecaudata* was associated with the presence of caves or mines.

The specimens were collected under the license 27524-1 (SISBIO) either in mist-nets, in open habitats, or by using hand nets, when captured in caves. All specimens were handled in accordance with the recommendations of Sikes *et al.* (2011). The voucher specimens were deposited in the mammal collection of the Universidade Federal da Paraíba (UFPB), in João Pessoa (Paraíba, Brazil) and in Laboratory of Conservation Biology (LBC) of the Universidade Federal de Sergipe, in São Cristovão (Sergipe, Brazil), after being fixed in 10% formaldehyde and preserved in 70% ethanol, with the subsequent extraction of the skull. A total of 13 specimens were collected between 2010 and 2012, five in two caves (Casa de Pedra and Miaba) in Sergipe (LBC 31, LBC 32, LBC 73, LBC 78, LBC 79), three in Paripiranga, Bahia (UFPB 6548, UFPB 6564, UFPB 6566), two in Boqueirão da Onça, Bahia (UFPB 6663, UFPB 6665), and three in Santa Quitéria, Ceará (UFPB 9255, UFPB 9256, UFPB 9257).

Casa de Pedra cave (10°50′ S, 37°27′ W) is located in the municipality of Itabaiana (Sergipe) and has a horizontal extension of around 200 m. The surrounding landscape is dominated by pastures and orchards, which are relatively dense along watercourses. In this cave, two individuals of *D. ecaudata* were spotted close (about 20 cm distance) of a group of approximately 200 individuals of *D. rotundus*. Miaba cave is located in the municipality of São Domingos (10°43′ S, 37°37′ W), close to the Vaza-Barris River, in an ecotone of the Atlantic Forest and Caatinga domains, known locally as the Agreste. A resident group of approximately 50 individuals of *D. ecaudata* was found at this site.

The Fim-do-Morro-do-Parafuso cave (10°41′ S, 37°51′ W) in Paripiranga, Bahia, is surrounded by grazing land and plantations of manioc and maize, with some fragments of shrubby caatinga mainly along the local rivers. Despite the large number of caves found in the area, 15 of which were inspected, *D. ecaudata* groups were found only in Fim-do-Morro-do- Parafuso. The second site in Ba-

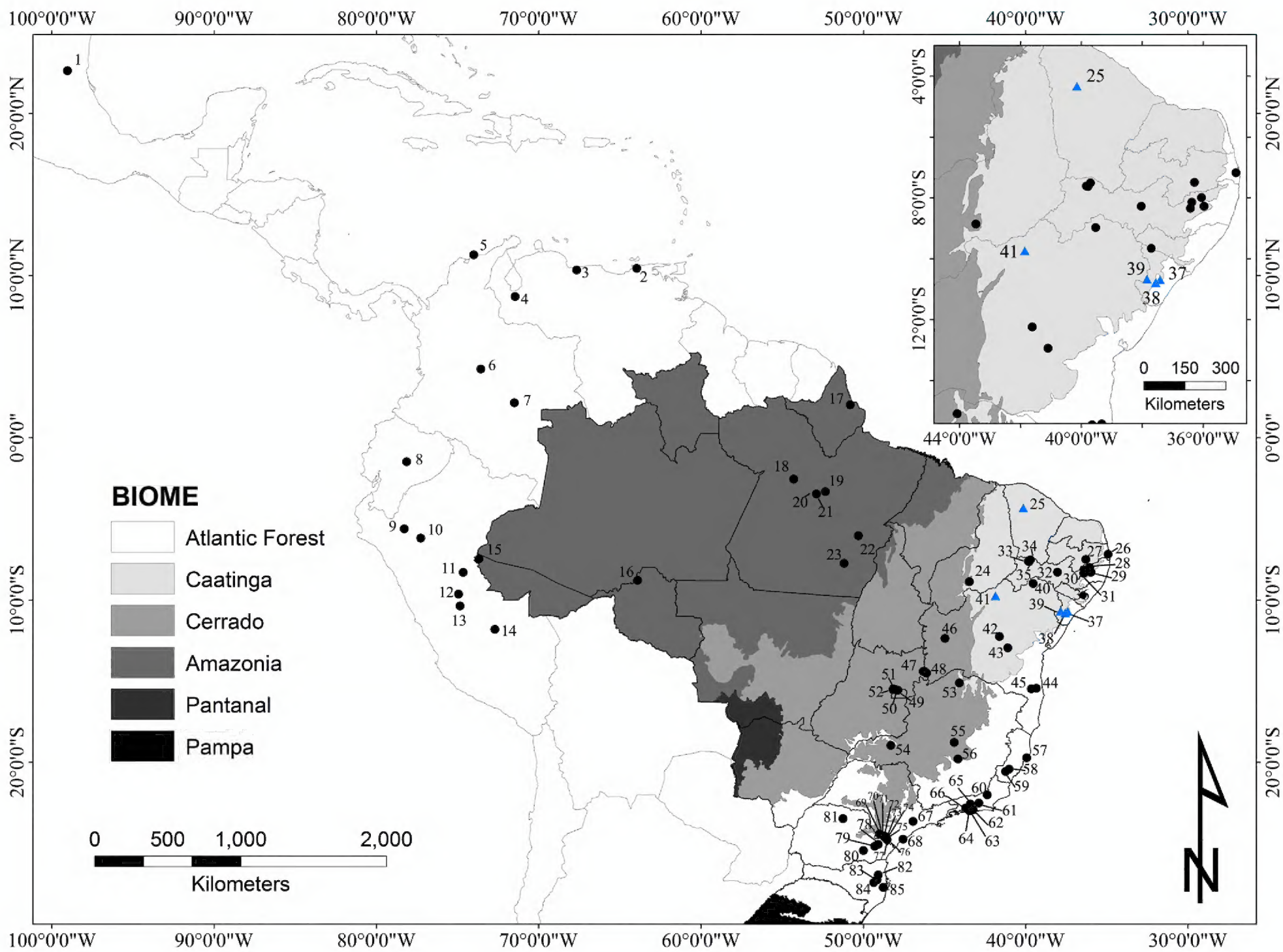

Figure 1. Map showing locality records of *Diphylla ecaudata* in Central and South America (blue triangles represent the new records assigned here). For key to code numbers see Table 1.

hia, Boqueirão da Onça (09°52′ S, 41°06′ W), in the municipality of Sento Sé, is characterized by a complex of hills and valleys covered by an arboreal caatinga (deciduous trees of 10–12 m height) that forms a closed canopy in the wet season (December–April). In the valleys, where the individuals were captured, the rivers retain moisture, even during the dry season, which allows the formation of dense, evergreen vegetation.

In Ceará, *D. ecaudata* specimens were captured near an abandoned mine in Santa Quitéria (04°33′ S, 39°46′ W), a region dominated by open, shrubby caatinga on shallow, stony soils (IPECE 2009). The region encompasses a number of intermittent watercourses, which are associated with denser patches of semideciduous woodland.

Diphylla ecaudata is the smallest vampire bat, with a head and body length of 75–93 mm, forearm of 50–56 mm, and weight of 24–43 g (Greenhall *et al.* 1984). This species feeds preferentially on the blood of birds, with bites being observed on the margin of the cloaca, and on the tarsus and feet (Gardner 1977). It is distinguished from the other desmodontines by the presence of two lower molars and a much wider postorbital constriction. Externally, the uropatagium, legs, and feet of *D. ecaudata* are conspicuously hirsute, the thumb is short (< 13 mm), with no basal pad, the eyes are large, and the ears short and rounded (Allen 1896; Greenhall *et al.* 1983).

Diphylla ecaudata is found primarily in natural refuges, in particular caves, where roosting sites may be selected according to environmental conditions (*e.g.*, humidity, temperature) and availability of crevices (Greenhall *et al.* 1984; Altringham 1996). Almost half (39) of the 86 records of the species in the wild have been obtained from surveys of caves (Table 1). At both sites in Sergipe, *Diphylla* was found cohabiting with *D. rotundus*. This latter species is generally more common than *D. ecaudata* not only in the local caves (PAR, personal observation), but also in those from southern (Trajano 1985) and central Brazil (Bredt *et al.* 1999). The greater selectivity of roosts observed in *D. ecaudata* may, at least partly, account for this difference; *D. rotundus* can often be found in man-made structures (Gomes and Uieda 2004).

This study expands considerably the known distribution of *D. ecaudata* in the caatinga scrub of northeastern Brazil—previously restricted almost entirely to the state of Pernambuco and neighboring areas—and represents the first record of this species for the state of Ceará, where a total of 35 chiropteran species are now known to occur (Gurgel-Filho and Langguth, in press). These findings further support the conclusion of Kwon and Gardner (2008) that the highly disjunct distribution of the species (Figure 1) may simply be due to a lack of adequate inventories.

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Table 1. Localities at which *Diphylla ecaudata* has been recorded. The code numbers refer to the points shown in Figure 1. Localities marked with an asterisk (*) are caves.

COUNTRY/ POINT	LAT-Y	LONG-X	STATE	LOCALITY	SOURCE
Mexico					
1	22.63333	-99.0333	Tamaulipas	Sierra Madre Oriental *	Elizalde-Arellano *et al.* (2007)
Venezuela					
2	10.45	63.96667	Sucre	21 km E of Cumaná	Handley (1976)
3	10.35	67.66667	Aragua	Portachuelo	Ojasti and Linares (1971)
4	8.7166667	-71.45	Mérida	Cueva de la Azulita	Ojasti and Linares (1971)
Colombia					
5	11.283333	-74	Magdalena	Cacagualito	Allen (1900)
6	4.25	73.56667	Meta	Restrepo	Aellen (1970)
7	2.1666667	-71.5	Vaupés	Cerro de las Pinturas	Wenzel *et al.*(1966)
Equador					
8	-1.4666667	78.13333	Pastaza	Mera	Albuja (1983)
Peru					
9	-5.6	78.28333	Amazonas	10 Km by trail SE of La Peca	Graham and Barkley (1984)
10	-6.1666667	77.26667	San Martín	Puca Tambo	Thomas (1926)
11	-8.2833333	-74.65	Ucayali	Yarinacocha	Sanborn (1949)
12	-9.6166667	74.93333	Huánuco	Panguana	Hutterer *et al.* (1995)
13	-10.35	-74.85	Pasco	Nevati	Tuttle (1970)
14	-11.783333	-72.7	Cusco	San Martín-3	Solari *et al.* (2001)
Brazil					
15	-7.45	73.68333	Acre	Parque Nacional da Serra do Divisor	Nogueira *et al.* (1999)
16	-8.7666667	-63.9	Rondônia	Porto Velho (USNM 562686)	Mok *et al.* (1982)
17	2.05	-50.8	Amapá	Macapá*	Peracchi *et al.* (1984)
18	-2.5333333	54.28333	Pará	Taperinha	Piccinini (1974)
19	-3.3	52.33333	Pará	Caverna Pedra da Cachoeira, Altamira *	Pinto-da-Rocha (1995)
20	-3.45	52.88333	Pará	Gruta Wukorangma, Medicilândia *	Pinto-da-Rocha (1995)
21	-3.45	52.88333	Pará	Gruta Upu Murem, Medicilândia *	Pinto-da-Rocha (1995)
22	6.0166667	-50.3	Pará	Gruta do (Xis), Parauapebas *	Pinto-da-Rocha (1995)
23	7.7166667	51.18333	Pará	Gradaús	Piccinini (1974)
24	-8.85	43.46667	Piauí	Parque Nacional da Serra das Confusões *	Gregorin *et al.* (2008)
25	-4.3166667	-40.15	Ceará	Santa Quitéria*	This Study
26	-7.4833333	36.28333	Paraíba	Fazenda Bravo, Cabaceiras	Feijó and Langguth (2011)
27	-7.1666667	34.91667	Paraíba	Caverna da Onça, João Pessoa *	Feijó and Langguth (2011)
28	-7.9833333	-36.05	Pernambuco	Pedra dos Pontais, Toritama	Astúa and Guerra (2008)
29	-8.2666667	35.96667	Pernambuco	Parque Ecológico Municipal Professor João Vasconcelos, Caruaru	Sousa *et al.* (2004)
30	-8.3333333	36.41667	Pernambuco	Sítio Coendou, Serra da Balança, Belo Jardim	Astúa and Guerra (2008)
31	-8.1333333	36.36667	Pernambuco	Pedra do Caboclo, Barra do Farias, Brejo da Madre de Deus*	Astúa and Guerra (2008)
32	-8.2666667	38.03333	Pernambuco	RPPN Maurício dantas, Betânia	Cruz *et al.* (2005)
33	-7.5	-39.7	Pernambuco	Exu	Mares *et al.* (1981)
34	-7.6166667	39.78333	Pernambuco	Fazenda Maniçoba, Exu	Mares *et al.* (1981)
35	-7.6	39.83333	Pernambuco	Serra da Farinha, Sítio da Gritadeira, Exu	Astúa and Guerra (2008)
36	-9.6333333	37.78333	Sergipe	Fazenda Mundo Novo, Canindé do São Francisco	Leal *et al.* (2013)
37	-10.683333	37.41667	Sergipe	Caverna Casa de Pedra, Itabaiana *	This Study
38	-10.783333	37.56667	Sergipe	Caverna da Miaba, São Domingos *	This Study
39	-10.666667	-37.85	Bahia	Caverna Morro do Parafuso, Paripiranga *	This Study
40	-8.9666667	39.53333	Bahia	Rio São Francisco	Type localyte of *D. ecaudata*
41	-9.7333333	41.86667	Bahia	Boqueirão da Onça, Sento Sé	This Study
42	-12.233333	41.61667	Bahia	Gruta da Fumaça, Iraquar*	Sbragia and Cardoso (2008)
43	-12.933333	-41.1	Bahia	Caverna Poço Encantado, Itaetê *	Gregorin and Mendes (1999)
44	-15.416667	39.33333	Bahia	Vale do Rio Pardo, Santa Luzia *	Faria *et al.* (2006)
45	-15.45	-39.65	Bahia	Vale do Rio Pardo, Pau Brasil *	Faria *et al.* (2006)
46	-12.35	44.96667	Bahia	Lapa do Manoel Lopes, São Desidério *	Pinto-da-Rocha (1995)
47	-14.383333	-46.3	Goiás	APA Nascentes do Rio Vermelho *	Esbérard *et al.* (2005)
48	-14.483333	-46.1	Goiás	Caverna Revolucionária, Mambaí *	Esbérard *et al.* (2001)
49	-15.533333	47.86667	Distrito Federal	Gruta da Saúva, Sobradinho*	Bredt *et al.* (1999)
50	-15.483333	-48.05	Goiás	Toca da Gameleira, Padre Bernardo*	Bredt *et al.* (1999)
51	-14.3833	-46.3	Goiás	Gruta Morro, Padre Bernardo*	Bredt *et al.* (1999)
52	-14.4833	-46.1	Distrito Federal	Gruta do Sal e Gruta Fenda II (Brazlândia, Fazenda Palestina) *	Bredt *et al.* (1999)
53	-18.9333	-48.3	Minas Gerais	Itacarambi	Trajano and Gimenez (1998)
54	-12.9333	-41.1	Minas Gerais	Uberlândia	Stutz *et al.* (2004)
55	-15.0833	-44.0833	Minas Gerais	Curvello	Almeida *et al.* (2002)

Table 1. *Continued.*

COUNTRY/ POINT	LAT-Y	LONG-X	STATE	LOCALITY	SOURCE
56	-19.8	44.18333	Minas Gerais	Fazenda Paraíso, Esmeraldas	Uieda (1992)
57	-20.55	-41.2333	Espírito Santo	Reserva Biológica dos Comboios, Linhares	Ruschi (1978)
58	-19.7	-39.9333	Espírito Santo	Reserva Biológica da Pedra Azul, Domingos Martins	Ruschi (1982)
59	-18.75	-44.4	Espírito Santo	Gruta do Limoeiro, Castelo *	Ruschi (1951)
60	-22.4833	-42.8833	Rio de Janeiro	Caverna Santana, Cantagalo *	Esbérard *et al.* (1998)
61	-22.9	-43.2333	Rio de Janeiro	Estação Ecológica do Paraíso	Esbérard (2007)
62	-21.9833	-42.3667	Rio de Janeiro	Reserva Biológica do Tinguá	Dias and Peracchi (2008)
63	-20.4	-41.0167	Rio de Janeiro	Rio de Janeiro	Uieda (1986)
64	-22.7833	-43.6833	Rio de Janeiro	Serra da Tiririca, Sítio Três Nascentes	Teixeira and Peracchi (1996)
65	-22.55	-43.4	Rio de Janeiro	Parque Estadual da Pedra Branca	Dias *et al.* (2002)
66	-22.9667	-43.4667	Rio de Janeiro	Universidade Federal Rural do Rio de Janeiro, Seropédica	Piccinini *et al.* (1991)
67	-22.8667	-43.3	São Paulo	Cotia	McNab (1969)
68	-23.6167	-46.9333	São Paulo	Iguapé	Pira (1904)
69	-24.55	-48.6667	São Paulo	Abismo do Tira Prosa, Ribeira *	Pinto-da-Rocha (1995)
70	-24.5833	-48.7	São Paulo	Caverna de Santana, Iporanga *	Pinto-da-Rocha (1995)
71	-24.5167	-48.7	São Paulo	Gruta Bethary de Baixo, Iporanga *	Pinto-da-Rocha (1995)
72	-24.55	-48.65	São Paulo	Ressurgência das Areias, Iporanga *	Pinto-da-Rocha (1995)
73	-24.7167	-47.55	São Paulo	Gruta do Alambari de Baixo, Iporanga *	Pinto-da-Rocha (1995)
74	-24.55	-48.6667	São Paulo	Gruta das Areias de Cima, Iporanga *	Pinto-da-Rocha (1995)
75	-24.5833	-48.7	São Paulo	Gruta das Areias de Baixo, Iporanga *	Pinto-da-Rocha (1995)
76	-24.4	-49	São Paulo	Vale do Ribeira, Iporanga *	Trajano (1985)
77	-25.0333	-49.0833	Paraná	Gruta São João, Adrianopolis *	Pinto-da-Rocha (1995)
78	-23.45	-51.25	Paraná	Gruta Fada, Parque Estadual de Campinhos *	Arnone and Passos (2007)
79	-25.4167	-50	Paraná	Gruta de Toquinhas, Rio Branco do Sul *	Pinto-da-Rocha (1995)
80	-24.5833	-48.5833	Paraná	Palmeira	Thomas (1900)
81	-25.15	-49.3	Paraná	Parque Estadual Mata do Godoy, Londrina	Reis *et al.* (2000; 2003;2012)
82	-27.2167	-49.15	Santa Catarina	Blumenau	Cherem *et al.* (2004)
83	-24.75	-48.5333	Santa Catarina	Gruta de Botuvera, Botuvera *	Pinto-da-Rocha et al. (2001)
84	-27.6833	-48.7667	Santa Catarina	Vidal Ramos	Cherem *et al.* (2004)
85	-26.9167	-49.0833	Santa Catarina	Santo Amaro da Imperatriz	Cherem *et al.* (2004)

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